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## INSPECTION PROCEDURE 88200 APPENDIX J

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### INSPECTION OF INSTRUMENTATION AND CONTROL SYSTEMS AT FUEL CYCLE FACILITIES

Effective Date: May 28, 2025

#### 88200.J-01 INSPECTION OBJECTIVES

- 01.01 To determine if safety-significant instrumentation and controls (I&C) system work is being performed in accordance with regulatory requirements, the licensing basis, specifications, drawings, and work procedures.
- 01.02 To determine if the applicant/licensee's system for preparing, reviewing, and maintaining records relative to safety-significant I&C system activities reflects work accomplishment consistent with specifications and procedures.
- 01.03 To determine if the as-built condition of safety-significant I&C systems meets the specified design requirements, specifications, and drawings. For installation of digital I&C system/software design, refer to Appendix M of this inspection procedure (IP).
- 01.04 To determine if the implementation of the management measures related to work activities for safety-significant I&C systems associated with items relied-on for safety (IROFS) is effective and to verify that deviations from requirements are appropriately resolved.

#### 88200.J-02 INSPECTION REQUIREMENTS

- 02.01 For the safety-significant items and services (SSIS) selected for inspection of I&C systems, determine whether procedures exist in the following areas, are compatible with the management measures program for IROFS, and prescribe adequate methods to meet the licensing basis and construction specifications, where applicable:
  - a. receipt inspection
  - b. storage and handling
  - c. installation activities
  - d. construction testing and calibration
  - e. configuration management
- 02.02 Determine whether the applicant/licensee has an established audit program (including plans, procedures, and audit schedule) for assessing the adequacy of work control functions and requirements, as applicable in their licensing basis, in the area of I&C system activities, and for ensuring that examination, inspection, and if required, test personnel associated with performing tests and inspections of safety-significant activities are qualified and/or certified to perform their assigned work.

- 02.03 Ascertain whether the following safety-significant I&C system activities, as required by licensing commitments and applicable construction codes, are being controlled and accomplished in accordance with the requirements of the documents reviewed in Inspection Requirement 02.01 above:
- a. receipt inspection
  - b. storage and handling
  - c. installation activities
  - d. construction testing and calibration
  - e. configuration management
- 02.04 Review the documentation generated for the safety-significant I&C system activities, as required by the licensing basis. Determine whether the applicant/licensee/contractor system for documenting safety-significant work is functioning in accordance with requirements. Records should be complete, reviewed by quality control (QC), engineering personnel, or designee, as required, and readily retrievable.
- a. receipt inspection and material certification
  - b. installation inspection
  - c. nonconformance/deviation record(s)
  - d. training/qualification records of craft, and quality inspection personnel (as required)
  - e. configuration management records

## 88200.J-03 INSPECTION GUIDANCE

### General Guidance

Inspectors should review the facility description in the integrated safety analysis (ISA), integrated safety analysis summary, or equivalent and be familiar with the SSIS being constructed at the site. The purpose of these as-built inspections is to verify that the assumptions and critical attributes reviewed during the licensing review process remain valid; the design was appropriately translated to construction specifications; the licensee/applicant constructed the facility in accordance with these specifications; and any modifications performed comply with the licensee's configuration management program and do not impact any NRC licensing decisions.

Inspectors should also be familiar with the licensee's management measures and/or quality assurance program, if applicable, and the licensing basis associated with these measures. It is not the objective of this IP to verify the adequacy of the applicant/licensee's management measures program, but inspectors should be prepared to identify potential gaps in the implementation of management measures for future inspections. Inspectors should complete this appendix by inspecting the attributes listed in this appendix for as-built I&C system work with a focus on SSIS, such as IROFS, or regulatory requirements, as applicable. Inspectors should also coordinate this appendix with inspection of digital I&C system/software design (Appendix M of this IP) for efficiency.

Inspectors should contact the applicant/licensee prior to the onsite inspection to help determine what samples are to be inspected. Observation during in-progress activities, like construction, installation, and testing, is desirable but not required. If necessary, inspectors may select completed systems for inspection. Inspectors should not attempt to inspect all available samples

but may expand if significant concerns with the applicant/licensee's control of installation/construction arise in this functional area.

Inspectors should collect applicant/licensee procedures, specifications, and work completion records in advance. If unable to review these documents in advance of the onsite inspection, then the licensee should be notified that these documents, and any other relevant documents, should be available when the inspector(s) arrives at the site.

Inspectors should choose one or more safety-significant I&C systems and review the areas listed in Inspection Requirements 02.01 through 02.04 to the extent practical and may use their judgment in determining which areas to concentrate on if time is limited.

### 03.01 Inspection Requirement 02.01

- a. Review construction specifications related to safety-significant I&C systems and ascertain whether the specified technical requirements conform to the commitments contained in the licensing basis.
- b. Review I&C system procedures and as applicable, verify that they specify provisions for adequate onsite engineering direction, are appropriate and adequate related to procurement and use of materials, specify adequate control of hold points, and provide adequate controls for design changes and incorporation of design changes into as-built drawings.
- c. Determine if appropriate and adequate procedures in the following areas are compatible with the management measures program, and prescribe adequate methods to meet the construction specifications, where applicable:
  1. receipt inspection
  2. storage and handling
  3. installation activities
  4. construction testing and calibration
  5. configuration management
- d. For the procedure review, consider the following attributes:
  1. Controls to ensure that the type and classification of I&C systems comply with approved drawings and/or specifications and meet licensee commitments.
  2. For IROFS, determine if procedures are compatible with the management measures program, and prescribe adequate methods to meet the construction specifications.

### 03.02 Inspection Requirement 02.02

- a. Review applicant/licensee's established audit program (including plans, procedures, and audit schedule) for assessing the adequacy of work control functions and requirements in their licensing basis, as applicable, in the area of safety-significant I&C system construction activities.
- b. Review audit program to verify if examinations and inspections are performed in accordance with applicant/licensee's requirements and if test personnel associated with

performing tests and inspections of safety-significant I&C system construction activities are qualified and/or certified to perform their assigned work.

- c. Verify records establish that required audits, as applicable, were performed and that deficiencies identified during audits were tracked and corrected.

### 03.03 Inspection Requirement 02.03

- a. Inspection of selected components and associated items of the instrument systems may be accomplished by observation, record review and/or independent evaluation of in-process and/or completed work. Sample selection should be based on importance to operational safety and should include redundant components and a diversity of components and locations if practical. Before inspection of selected items, review the specifications, drawings, work procedures, management measure procedures, and work schedules applicable to the systems and components selected for inspection. Below are examples of types of samples the inspector(s) may use during this inspection: safety-significant items including, as applicable, emergency control systems and display instrumentation.
- b. Ascertain whether the following activities, as required by licensing commitments and applicable construction codes, are being controlled and accomplished in accordance with the requirements of the documents reviewed in Inspection Requirement 02.01, above:
  - 1. Receipt Inspection. Observe and evaluate a sample of receipt inspection activities pertaining to instrumentation components and associated items. Determine whether receiving inspection activities are being controlled and performed in a manner which will ensure that applicable requirements are satisfied in the following areas:
    - (a) I&C components and receiving documents are properly identified.
    - (b) Physical condition (damage, deterioration, etc.).
    - (c) Documentation relative to quality requirements (e.g., results of functional and qualification testing) received with components and associated items is reviewed and meets the requirements. Where qualification testing of components to be placed in a harsh environment is not a requirement of the specification, review existing documentation that establishes acceptance criteria and environment requirements that define what means will be used to assure that applicable environmental qualification will be satisfied.
    - (d) Control of nonconforming components.
    - (e) Adequate number of qualified personnel, as applicable, are available to perform the receiving inspection function.
    - (f) The licensee should identify and describe all instrument components which must operate in a hostile environment (e.g., high radiation, temperature, humidity) during or subsequent to an accident. Where environmental qualification testing, or other qualification provisions (such as seismic) are specified, receiving inspection activities should include verification that required testing has been satisfactorily completed.

- (g) All required documentation may not be received with the components. If not, the inspector should at this time determine that the licensee is following their system for identifying, controlling, and maintaining the status of the required documentation. This system should ensure eventual documentation of satisfactory completion of required testing.
2. Storage and Handling. Observe and evaluate a sample of storage activities and conditions for the inspection samples. Determine whether:
- (a) Components are stored in the proper storage level designation.
  - (b) Components are properly identified.
  - (c) Storage conditions (temperature, humidity, cleanliness, etc.) are controlled and monitored as specified.
  - (d) Licensee and contractor inspection and monitoring activities are being performed in accordance with procedural requirements.
  - (e) Nonconforming items placed in storage are identified and/or segregated, as required.
  - (f) In place storage requirements are satisfied.
  - (g) Provisions should include procedures for monitoring or surveillance of locally mounted instruments by inspection QC personnel. They should ensure that maintenance requirements while “stored in place” are satisfied and that adequate protection is provided against possible damage from adjacent construction activities, including construction traffic. (Where protective means used during construction may affect proper operation, provisions should be provided for timely removal.)
  - (h) Control of storage conditions for equipment stored in place usually requires special effort. The inspector should note whether the procedurally required storage conditions are being maintained.
  - (i) Readily visible and permanently marked tags or other identifying scheme should be used for all nonconforming components and materials, and records relative to the nonconformance should be available at the site and readily retrievable.
3. Installation Activities.
- (a) In-Process Work. If in-process work is occurring at the time of the inspection, observe and evaluate portions of the in-process installation activities for the inspection sample. Determine whether:
    - (1) The latest approved revision of applicable construction specifications, drawings, and/or procedures are available and used by the installers.
    - (2) The components are as specified, such as: type, range, proof pressure/rating and material.

- (3) Associated mounting hardware and supports are of the type and material specified and properly located. Anchor bolts holding or mounting instrument components should be of the type, size and length specified. Provisions should exist to prevent indiscriminate cutting of reinforcement steel during the drilling of anchor holes.
  - (4) The components are installed in the proper location and orientation by qualified craft personnel using suitable equipment and tools.
  - (5) Evaluate sensitivity to grounding connections and lightning protection system down comers.
  - (6) The required component identification is properly maintained or established.
  - (7) Licensee and contractor inspections are performed, or scheduled to be performed, before closing out the work to be inspected.
  - (8) Inspection activities are timely and properly completed by qualified personnel.
  - (9) Installed components are adequately protected from damage by adjacent construction activities.
  - (10) Nonconformance issues are identified and handled in accordance with established procedures. Where corrective action is being taken, determine whether it meets the appropriate requirements.
- (b) Completed Work. Observe and inspect the completed installation of I&C system components. Determine whether:
- (1) Location, configuration and installation (including mounting and anchoring) are in accordance with the latest approved design or construction specifications and drawings.
  - (2) Specified instrument components and associated items have been used.
  - (3) Components have been correctly and permanently identified.
  - (4) Cleanliness requirements have been maintained or otherwise satisfied.
  - (5) Installed equipment is adequately protected from adjacent construction activities and protective coatings, plugs, bushings, and other materials have been used as specified.
  - (6) Instrument components and associated items, such as sensing lines and power supplies; maintain physical and electrical independence between redundant parts.
  - (7) Protection systems and normal plant control systems are adequately separated and isolated from each other.
  - (8) Nonconforming components or conditions have been identified and controlled in accordance with approved procedures.

- (9) Status of completion, maintenance, and readiness for pre-operational testing is indicated or otherwise documented.
  - (10) Adequate actions or provisions have been taken or maintained (as needed) to ensure that the validation of the environmental qualification of instrument components is maintained.
  - (11) Wiring and terminations, including grounding, are installed in compliance with construction drawings and specifications.
- (c) **As-Built Verification.** Verify I&C system components are installed and inspected by obtaining the latest revision (as-built, if available) of instrument and installation drawings.
- (1) Review construction specifications and other applicable documents referenced by drawing or otherwise.
  - (2) Compare the actual installation of the components selected with the drawings.
  - (3) Discrepancies observed may result from in-process changes, such as those initiated in the field. If in-process changes are involved, determine whether the licensee has properly controlled and documented these changes for engineering review, approval, and subsequent incorporation into the final as-built drawings.
4. **Construction Testing and Calibration.** Observe a sample of construction testing and calibration activities for applicable components from the sample selected in subsections of section 02.03. Determine whether:
- (a) The latest revisions of applicable procedures and/or specifications are available at the work location and used by personnel performing the testing and calibration.
  - (b) Properly identified, traceable and calibrated measuring and test equipment are used.
  - (c) Equipment or components calibrated are able to obtain the set point, degree of accuracy, and/or tolerance specified or otherwise noted.
  - (d) Required testing and calibration results are recorded during the activity, not after the work has been completed.
  - (e) Components are adequately identified as having been tested or calibrated.
  - (f) Personnel performing the testing and calibration are properly qualified.
  - (g) Test and calibration personnel adhere to any special handling or removal requirements.
5. **Configuration Management.** For the activities observed during Inspection Requirement 02.03., verify if changes occurred during these construction activities, the applicant/licensee properly controlled and documented these changes for

engineering review, approval, and subsequent incorporation into the final as-built drawings, as applicable. Verify these actions were completed in accordance with their procedures and management measures, as applicable.

#### 03.04 Inspection Requirement 02.04

Ascertain whether for the I&C system activities, the applicant/licensee/contractor system for documenting safety-significant work is functioning properly, as applicable.

Review licensee and contractor requirements covering the scope of records for safety-significant I&C system components to (1) determine who prepares each quality-related record, who reviews the records for accuracy and who ensures that the recorded information meets requirements, as applicable; and (2) evaluate the information obtained above and determine whether the established record management system satisfies management measures program and licensing requirements.

- a. Receipt Inspection and Material Certification. Select records applicable to the receipt of lots or shipments. Select records applicable to the storage, and storage inspection of lots or groups of I&C system/components and associated items.
  1. Records confirm that required material characteristics, performance tests, nondestructive tests, environmental qualification tests, and other specification requirements are met.
  2. Receipt inspection and storage records indicate that, where appropriate, defective or incorrect components, parts, and materials are controlled and prevented from installation and possible use.
  3. Documentation has been prepared and maintained as required by receipt inspection and documentation storage instructions.
- b. Installation Inspection.
  1. Records confirm that specified materials and components were installed as specified and that the required construction inspections were performed, and acceptance criteria are defined.
  2. Review licensee and contractor requirements covering the span of records for I&C systems. Determine the initiation point for those records sampled and, importantly, the effectiveness of those responsible for reviewing the records for accuracy and completeness and ensuring that the recorded information meets documentation requirements. To determine the effectiveness of the licensee or contractor system for documenting work in this area, verify that:
    - (a) Type and classification of pipe support or restraint comply with appropriate drawings and specifications.
    - (b) Location, spacing, and critical clearances meet licensee's specifications and have been verified by construction QC inspections.
    - (c) The required scope of licensee construction QC inspections was met.



3. Review and evaluate pertinent quality records in a sampling of the areas listed below. Determine whether:
  - (a) adequate preparation, control, review, and evaluation of these records have been made
  - (b) records reflect that appropriate requirements have been met
  - (c) the system of records is functioning properly
- c. Nonconformance/Deviation Record(s).
  1. Records include current status of these items. Nonconformance reports include the status of corrective action or resolution, (e.g., determine whether adequate corrective action is being taken when test results are not within tolerance or acceptance criteria.)
  2. For the inspection, review and evaluate a sampling of reports applicable to nonconformances or deviations. Determine whether:
    - (a) Records are complete and promptly reviewed by qualified personnel.
    - (b) Records have been routinely processed, evaluated in a timely manner and controlled through established channels, for resolution of the root-cause as well as the immediate problem.
    - (c) Records are properly identified and stored, indicate current status, and can be retrieved in a reasonable time.
    - (d) Nonconformance reports include the status of corrective action or resolution, and adequate justification is provided for use-as-is disposition.
- d. Training/Qualification Records of Craft, and Quality Inspection Personnel. Records establish that quality inspection personnel, as applicable, are adequately qualified for their assigned duties and responsibilities and that craft personnel have been trained in their assigned tasks. Records are complete and current and show which activities inspectors are qualified to perform.
- e. Configuration Management Records. Review and evaluate a selected sample of configuration management records, and determine whether:
  1. Records associated with design and field changes, as well as related work and IP changes, reflect that timely review and evaluation of design and field change documents have been performed by personnel who are qualified.
  2. Records of periodic inspections ensure that only the most recent approved documents, including design changes, were used in the field.
  3. Design changes are subject to adequate design control, including consideration of the impact of the change on the overall design and on as-built records.

4. Records of nonconformance's to design requirements include preparation of a nonconformance report even if the nonconformance is resolved through the design-change process.

#### 03.05 Additional Guidance

Note: Personnel Interviews. Informal interviews with field-craft and inspection personnel may be randomly conducted to determine how well employees know the requirements of their work activity. Ascertain whether a sufficient number of adequately qualified QC inspection personnel, if required, are at the construction site, commensurate with the work in progress, and adequately performing their assigned duties through the established organizational structure.

##### a. Specific Instrument Components and Associated Devices

I&C system components consist of those elements that are designed to measure, monitor, transmit, modify, display, alarm, record and/or control various plant variables or conditions. This IP, and other instrumentation IPs, apply, but are not limited, to the following safety related instrument components and associated items: sensors, transmitters, isolators, signal conditioners, controllers and other actuating devices, recorders and other printing devices, indicators, alarms, switches, logic devices, interlocks, bypasses, instrument valves, fittings, tubing, instrument air supplies, internal power supplies or regulators, protective devices, control boards, racks, panels, cabinets, supports, anchor and mounting hardware, communication devices, multiplexers, data concentrators, engineering workstations, human-machine interface devices (e.g., displays), interconnecting means for integrity and applicability, and network management devices and tools.

In addition to observing whether specific instrument components and associated devices are as specified (properly identified, located, mounted, etc., as required), it is important also to ascertain whether certain components or conditions do not exist where prohibited. For example, instrument components are not exposed to potential hazards from other construction activities. Because of the complexity of digital components, and the potential for interconnection between safety components and between safety and non-safety components, the inspector should consider these issues during the inspection. Although the safety sensor may be hardwired to the controller, the controller may be communicating over a digital bus with other controllers, the operator, or an annunciator system. Also, some sensors are "smart" in that they have on-board diagnostics and calibration tables, so, even though they are "hardwired," they could still be using some communication link with the controller (e.g., HART superimposes digital monitoring and command signals on an analog 4-20mA signal).

The licensee should identify and describe all safety-significant I&C components which must operate in a hostile environment (e.g., high radiation, temperature, humidity) during or after an accident. Where environmental qualification testing, or other qualification provisions (such as seismic) are specified, the licensee should establish means to assure that the results of this testing are documented, reviewed, and determined to be acceptable. If this is not performed when components are received, the procedures should specify the organization that will be performing this review and the controls to ensure that all such documentation requirements are satisfied before the component is placed in use.

The inspector should also be aware of memory-related integrated circuit chips (programmable read only memory, flash memory, etc.) that have certain versions of application code (i.e., specific version of firmware). The inspector should verify that the configuration management program is tracking these versions—not just firmware, but all electronic devices that may have embedded processors, memory, etc. In addition, for safety related electronic components, the inspector should verify that the supplier or licensee followed the supply chain to ensure no unauthorized replacements have occurred.

Instrument components may be released for installation on the merits of certifications of conformance if the organization involved has established a satisfactory program control and audit requirements in this area. However, certifications of conformance do not release the licensee from having other records (such as environmental or seismic qualification records) for operation and for the life of the plant.

Examples of process variables used by the emergency control system are some manual and automatic controls for power distribution, ventilation, and seismic isolation systems. Associated and interrelated devices include signal conditioning components, isolation devices, interlocks, bypasses, selector switches, resets, overrides, instrument tubing, racks, panels, and their supports, instrument wiring and wiring terminations. The licensing documents should include the specific variables, as well as the logic and devices, used in the system.

Examples of sensors which provide information to automatic controllers are devices for measuring/monitoring temperature, mass, physical dimension, component identification bar codes, and machine tool positions.

Examples of controllers which are required to mitigate accidents are the safety controllers and emergency controls. The licensee should specify the specific variables, as well as the logic and logic devices used in the system.

- b. Prevalent Problems and Concerns. Areas in which the inspector should be alert to potential generic issues. This section is included to provide background for inspectors on past piping supports and restraints issues related to construction experience at previous projects. (Note: These are not listed in order of their perceived importance to safety.) These areas include:

1. Adequate procedures or other means have not been established to assure and document that all safety-significant I&C components have met applicable acceptance criteria or to identify and document non-conformances in specific areas.
2. Inspection procedures do not include adequate inspection requirements and acceptance criteria.
3. Inadequate means to control location and status of instrumentation components—especially during removal for calibration, modification, repair or replacement.
4. Inadequate procedures to control the evaluation, approval and use of field changes. (Means should be established also by the licensee or contractor to assure that only the latest approved field changes and other revisions or changes are being used for installation and inspection activities).

## 88200.J-04 RESOURCE ESTIMATE

This appendix is intended to provide inspection requirements and guidance applicable to a wide variety of potential construction projects at both existing and new fuel cycle facilities (FCFs). These projects may vary greatly in scope, complexity, and potential risk to public health and safety. Recommended inspection scope and hours for a specific new FCF will be documented in the principal inspection plan (PIP) for that facility developed in accordance with Inspection Manual Chapter (IMC) 2694, "Fuel Cycle Facility Construction and Pre-Operational Readiness Review Inspection Program."

Additionally, this IP can be used to provide additional inspection guidance for plant modification inspections at existing facilities but is not required to be implemented for these projects. Use of this appendix, or sections of this appendix, for modifications at existing FCFs, would be done on a case-by-case basis, in accordance with IMC 2600, Appendix B, "NRC Core Inspection Requirements."

## 88200.J-05 PROCEDURE COMPLETION

This inspection procedure is complete when the applicable appendices or applicable appendix sections are completed for the facility, as determined by the PIP. Inspectors are not expected to complete every activity in the appendices of this IP. Instead, inspectors should prioritize inspection activities based on 1) importance of the activity to safety, 2) availability of the on-site activity at the time of the inspection, and 3) available inspection resources. This appendix does not need to be completed if there are no SSIS covered by this appendix at a FCF.

## 88200.J-06 REFERENCES

Refer to licensing basis requirements for applicable codes and standards for each fuel facility.

American National Standards Institute (ANSI) / Institute of Electrical and Electronic Engineers (IEEE) Standard (Std.) 336, "IEEE Standard Installation, Inspection, and Testing Requirements for Power Instrumentation, and Control Equipment at Nuclear Facilities"

ANSI/IEEE 802.3 Standards Series, "IEEE Standards for Local Area Networks: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications"

IEEE Std. 518, "IEEE Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources"

IEEE Std. 1050, "Guide for Instrumentation and Control Equipment Grounding in Generating Stations"

ISA-S12.13-Part 1, "Performance Requirements, Combustible Gas Detectors"

ISA RP12.13-Part II, "Installation, Operation, and Maintenance of Combustible Gas Detection Instruments"

NUREG-0700, "Human-System Interface Design Review Guidelines"

NUREG-0800, Standard Review Plan, Branch Technical Position HICB-11, "Guidance on the Application and Qualification of Isolation Devices"

NUREG-0800, Standard Review Plan, Branch Technical Position HICB-17, "Guidance on Self-Test and Surveillance Test Provisions"

Regulatory Guide (RG) 1.118, "Periodic Testing of Electric Power and Protection Systems"

RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems"

RG 1.75, "Physical Independence of Electric Systems"

RG 3.17, "Earthquake Instrumentation for Fuel Reprocessing Plants"

END

List of Attachments:

1. Revision History Table

Attachment 1: Revision History for IP 88200 Appendix J

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional Non-Public Information)
	ML24332A168 05/28/25 CN 25-014	Initial issuance. Discipline specific appendix developed to provide technical inspection guidance for new construction and major modifications activities for fuel facilities with varying technologies, size, licensing requirements, etc.	N/A	N/A